TEST REPORT

1. Applicant
   - Name : Hitec RCD, Inc.
   - Address : 12115 Paine Street, Poway, CA 92064, USA
   - FCC ID : IFHECL7PRO24G
   - IC : 3420A-ECL7PRO24G
2. Products
   - Name : 2.4GHz RADIO CONTROL SYSTEM
   - Model/Type : ECLIPSE 7 PRO 2.4G / AFHSS(GFSK)
   - Manufacturer : Hitec RCD PHILIPPINES, INC.
3. Test Standard : 47 CFR FCC Part 15 Subpart C
   RSS-210 Issue 8
4. Test Method : ANSI C63.4-2003
5. Test Result : Positive
6. Dates of Test : July 12, 2011 to July 14, 2011
7. Date of Issue : July 15, 2011
8. Test Laboratory : Korea Standard Quality Laboratories
   FCC Designation Number : KR0024
   IC OATS Number : 9053A

Tested by

SoonHo, Kim

Test Engineer:

Approved by

SungBum, Hong

Compliance Engineer:

Korea Standard Quality Laboratories
Testing Laboratories for EMC and Safety Compliance
www.ksqlab.com #102, Jangduk-Dong, Hwasung-City, Kyunggi-Do, KOREA

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** APPENDIXS

1. EUT photo

1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 and RSS-210 Issue 8 – Category I Equipment, Annex 8. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by Korea Standard Quality Laboratories and were made under Chief Engineer''s supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

Korea Standard Quality Laboratories

2.1 Location

#102, Jangduk Dong, Hwasung City, Kyunggi Do, South Korea
(FCC Designation Number : KR0024)

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

2.2 Test Date

Date of Test: July 12, 2011 to July 14, 2011

2.3 Test Environment

See each test item''s description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user''s manual.

3.1 Rating and Physical Characteristics

Model	ECLIPSE 7 PRO 2.4G
Power source	DC 7.2 V Li-ion battery
Transmit Frequency	2405.6 ~ 2477.6 MHz (121 channels)
Antenna Type	Integral (1/2 Wave Dipole Antenna, Gain: 0.71 dBi max.)
Type of Modulation	AFHSS (GFSK)
Size	185×320×90(mm)
Weight	800g

3.2 Equipment Modifications

None.

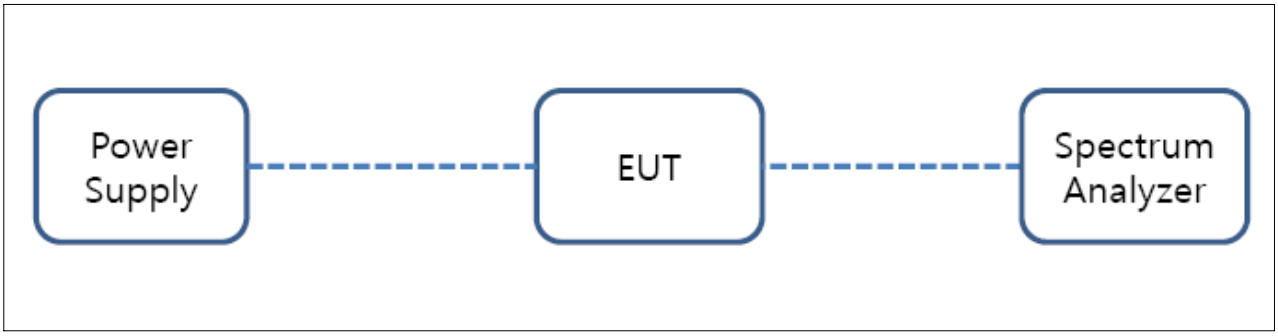
3.3 Submitted Documents

Block diagram
Schematic diagram
Antenna Specification
External photos
Test setup photos
Part List
Tune up Procedure
Label Location
User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The measurements were taken in continuous transmitting mode using the TEST MODE. For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.



[System Block Diagram of Test Configuration]

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	S/N
-	-	-	-
-	-	-	-

** For control of the RF module via SPI interface in the EUT. For radiated spurious emission measurements, setting the EUT to TEST MODE.

4.3 Type of Used Cables

#	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
1	-	-	-	-	-	-
2						

5. TEST AND MEASUREMENT

Summary of Test Reaults

Requirement	CFR 47 Section	RSS Standards	Report Section	Test Result
Antenna Requirement	15.203, 15.247(b)(4)	RSS-Gen, 7.1.4	5.1	PASS
20dB Bandwidth	15.247(a)(1)	RSS-210, A8.1 (b)	5.2	PASS
Maximum Peak Output Power	15.247(b)(1)	RSS-210, A8.4 (2)	5.3	PASS
Power Spectral Density	15.247(e)	RSS-210, A8.2	5.4	PASS
Carrier Frequency Separation	15.247(a)(1)	RSS-210, A8.1 (b)	5.5	PASS
Number of Hopping Channels	15.247(a)(1)(iii)	RSS-210, A8.1 (d)	5.6	PASS
Time of Occupancy (Dwell Time)	15.247(a)	RSS-210, A8.1 (d)	5.7	PASS
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.209	RSS-210, A8.5 RSS-210, A8.1(b)	5.8	PASS
Receiver Spurious Emissions	-	N/A	N/A	N/A
RF Exposure	15.247(i), 1.1307(b)(1)	RSS-Gen, 5.5 RSS-102, 2.5	5.10	PASS

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result : PASS

The transmitter has an integral Chip antenna. The directional gain of the antenna is 0.90 dBi.

5.2. 20dB BANDWIDTH

5.2.1 Regulation

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

According to §RSS-210, A8.1(b), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

5.2.2. Test Condition

- Set RBW of Spectrum analyzer to 10 kHz, Span=3MHz, Sweep=auto
- The 20dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 20dB . Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater

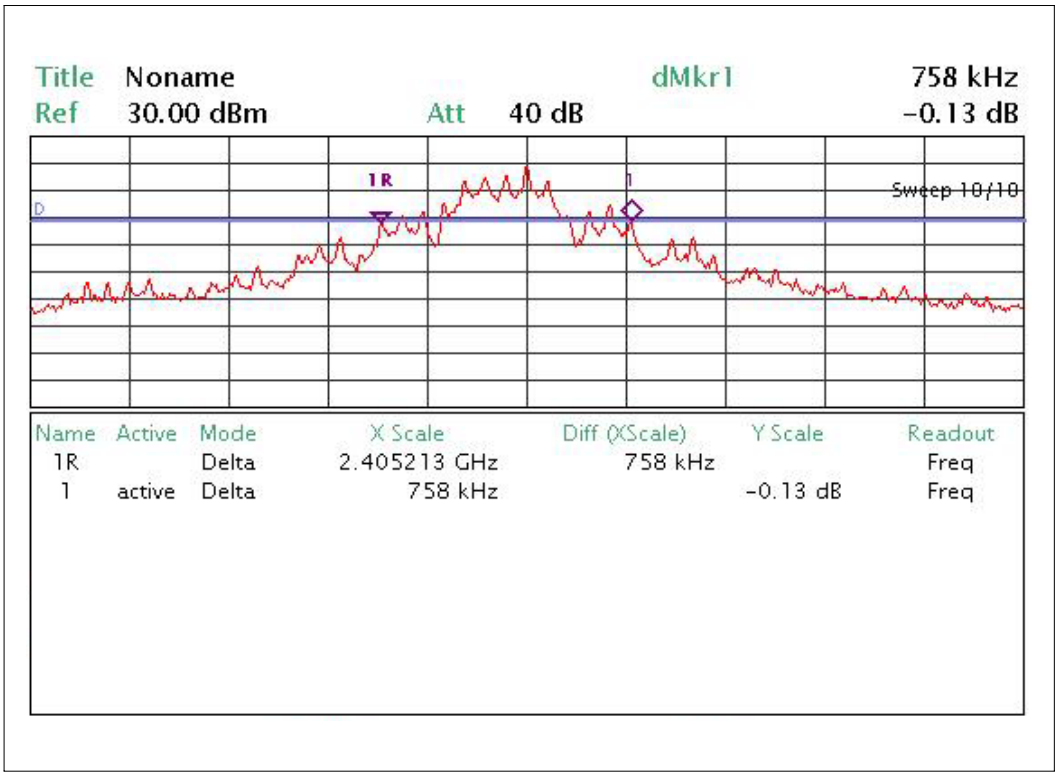
5.2.3. Test result : PASS

Table 1 : Measured values of the 20dB Bandwidth

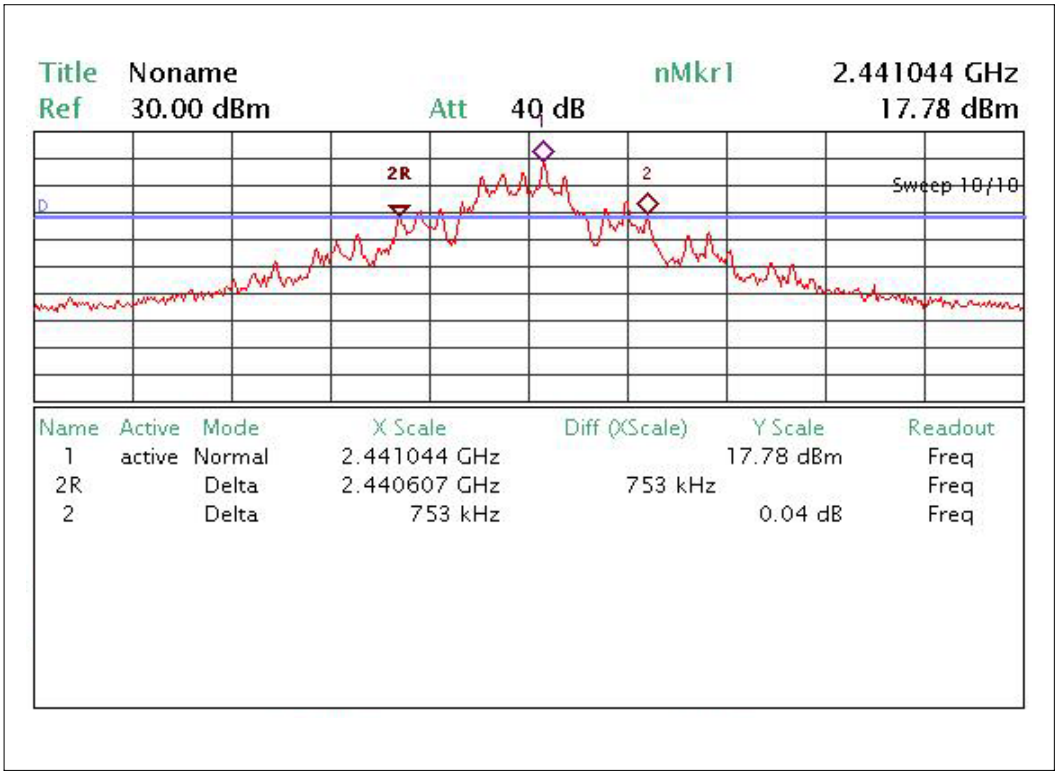
Modulation	Frequency (MHz)	Result (kHz)	Verdict
GFSK	2405.6	758	Pass
	2441	753	Pass
	2477.6	796	Pass

Figure 1. Plot of the 20dB Channel Bandwidth

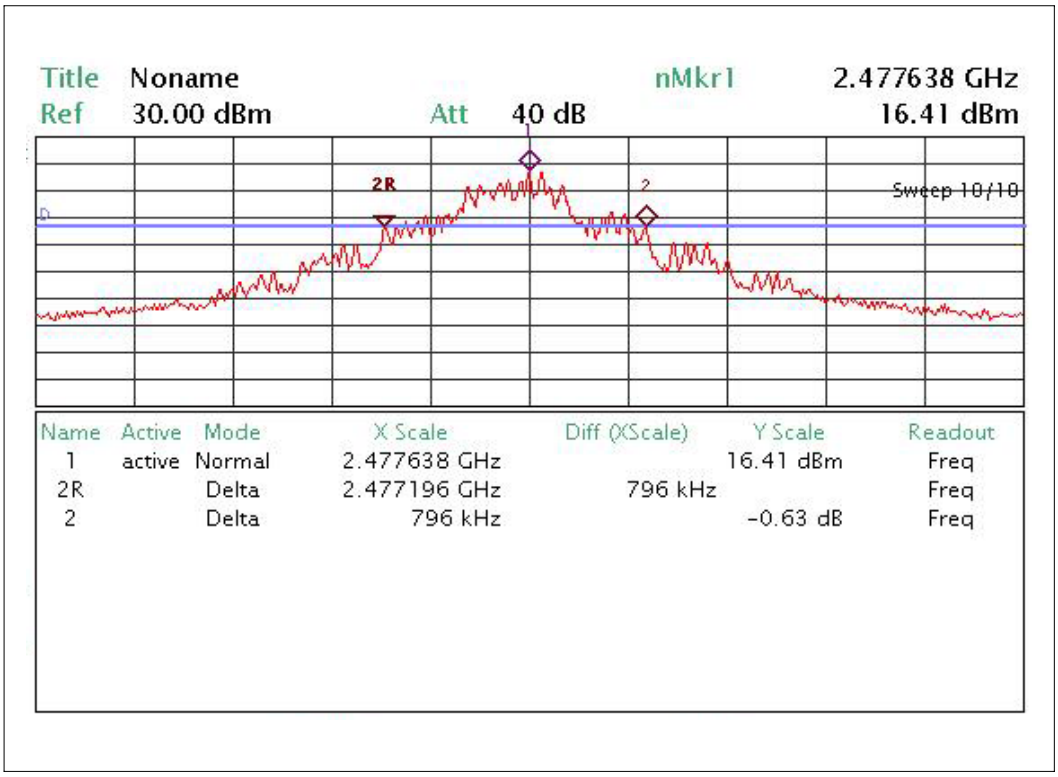
Lowest Channel (2405.6 MHz)



Middle Channel (2441 MHz)



Highest Channel (2477.6 MHz)



5.3. MAXIMUM PEAK POWER

5.3.1 Regulation

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §RSS-210, A8.4(2), For frequency hopping systems operating in the band 2400-2483.5MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4W.

5.3.2 Test Condition

- Set RBW of Spectrum analyzer to 1 MHz
- The Maximum Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

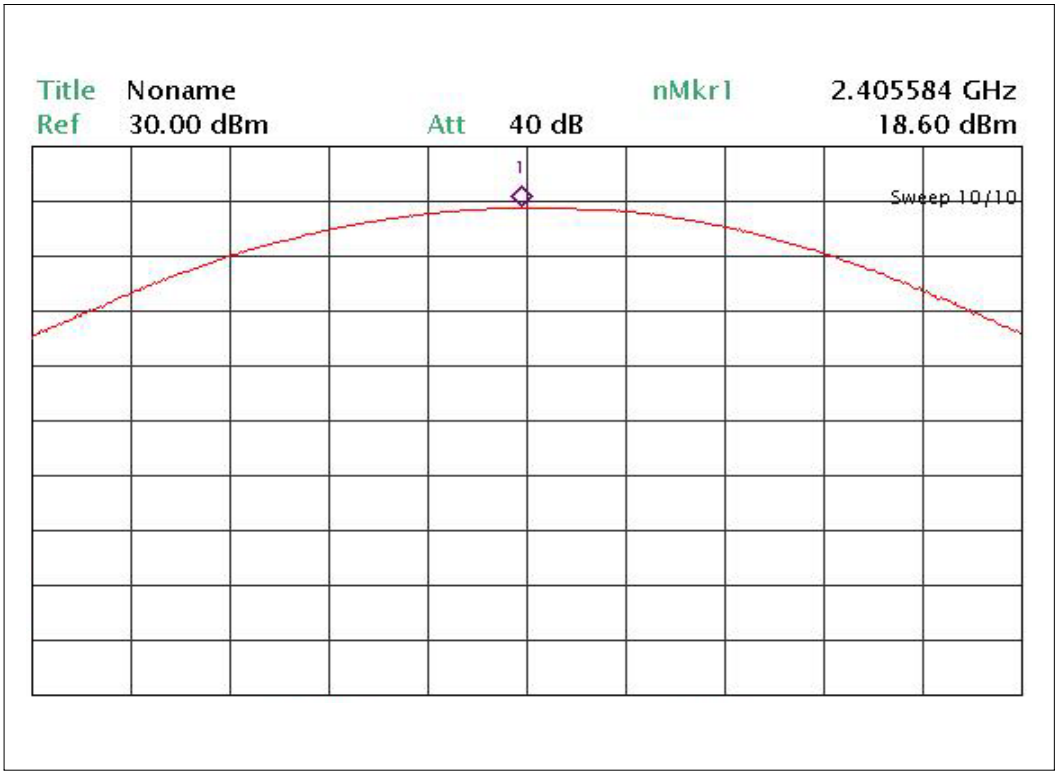
5.3.3 Test result : PASS

Table 2 : Measured values of the Maximum Peak Output Power(Conducted)

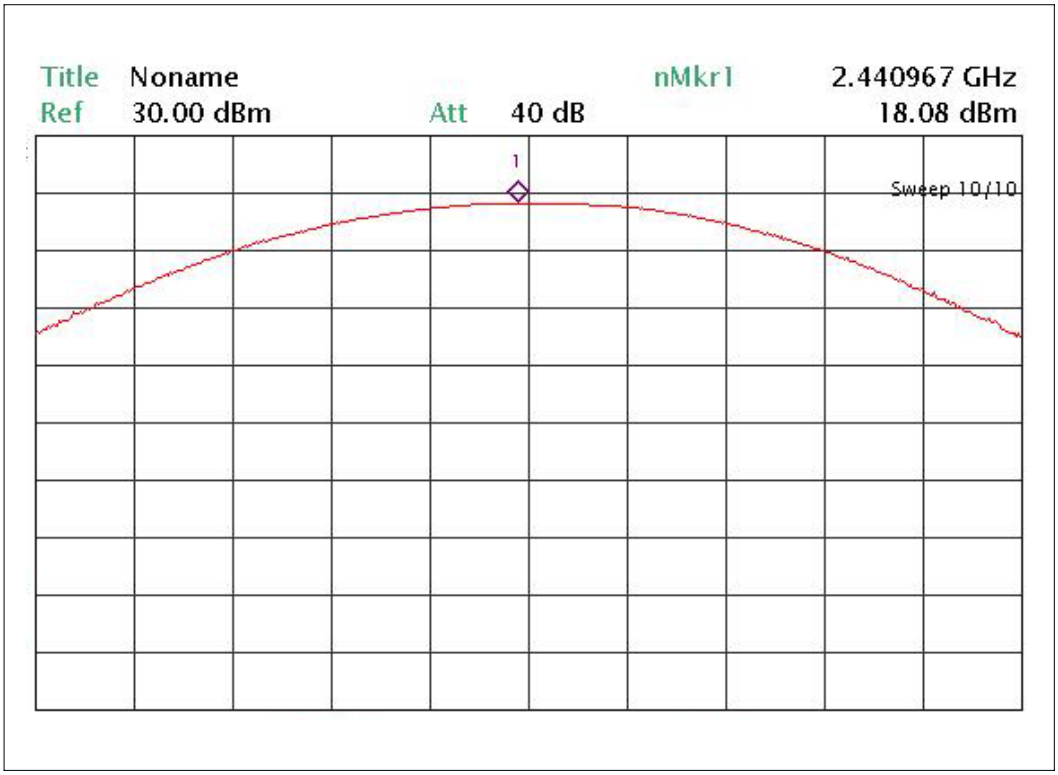
Modulation	Frequency (MHz)	Reading Power (dBm)	Output Power (mW)	Limit (mW)	Verdict
GFSK	2405.6	18.60	72.44	125	Pass
	2441	18.08	64.26	125	Pass
	2477.6	16.78	47.64	125	Pass

Figure 2. Plot of the Maximum Peak Output Power

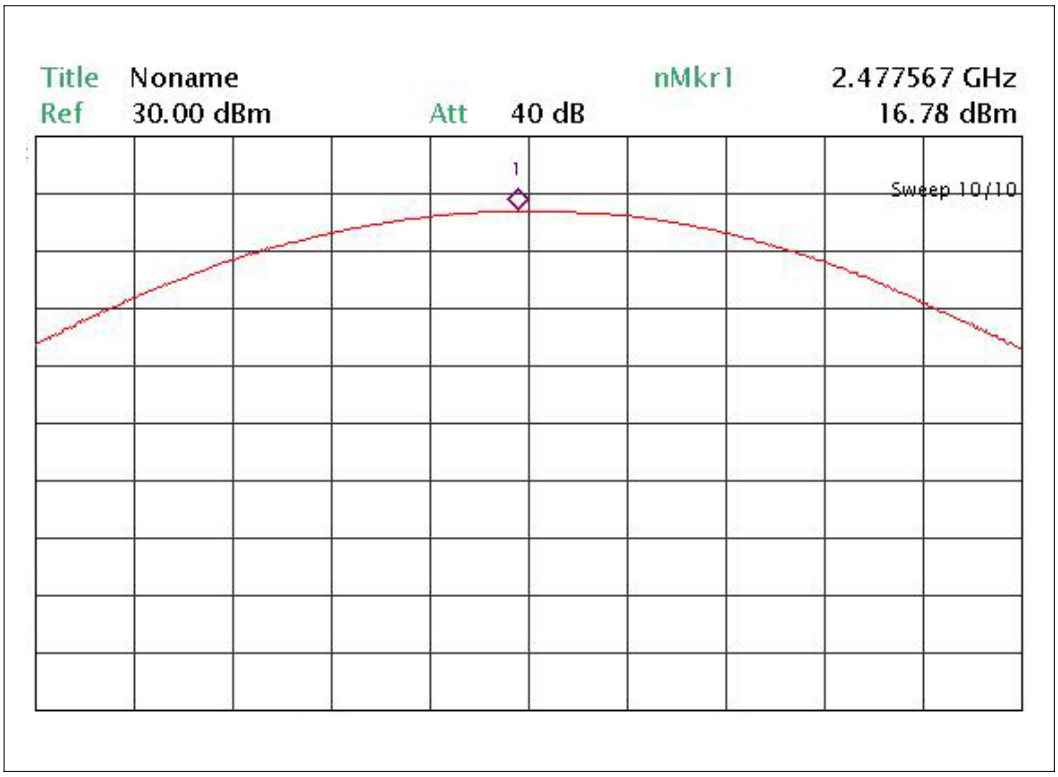
Lowest Channel (2405.6 MHz)



Middle Channel (2441 MHz)



Highest Channel (2477.6 MHz)



5.4. POWER SPECTRAL DENSITY

5.4.1 Regulation

According to §15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

According to §RSS-210, A8.2, These include systems employing digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to all three bands: (a) The minimum 6 dB bandwidth shall be at least 500 kHz. (b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration. This power spectral density shall be determined in accordance with the provisions of Section A8.4(4); (i.e. the power spectral density shall be determined using the same method for determining the conducted output power).

5.4.2 Test Condition

- Set Spectrum analyzer as RBW = 3 kHz, VBW = 3kHz, Span = 900kHz
- Record the max. reading

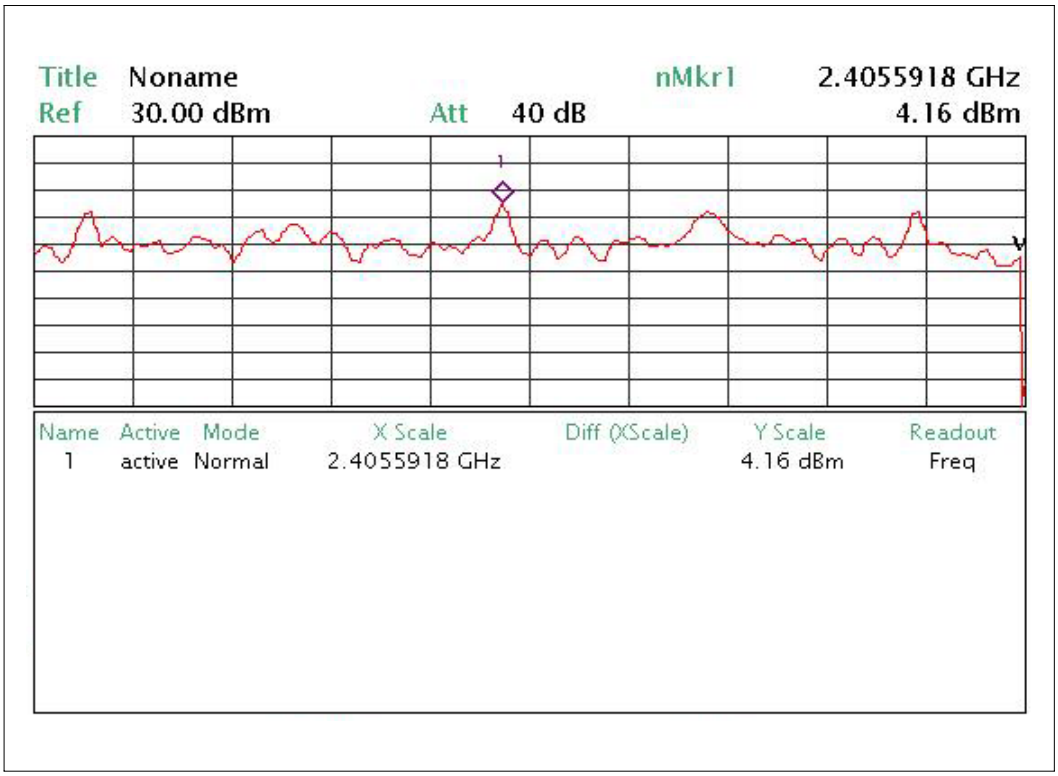
5.4.3 Test result : PASS

Table 3 : Measured values of the Power Spectral Density

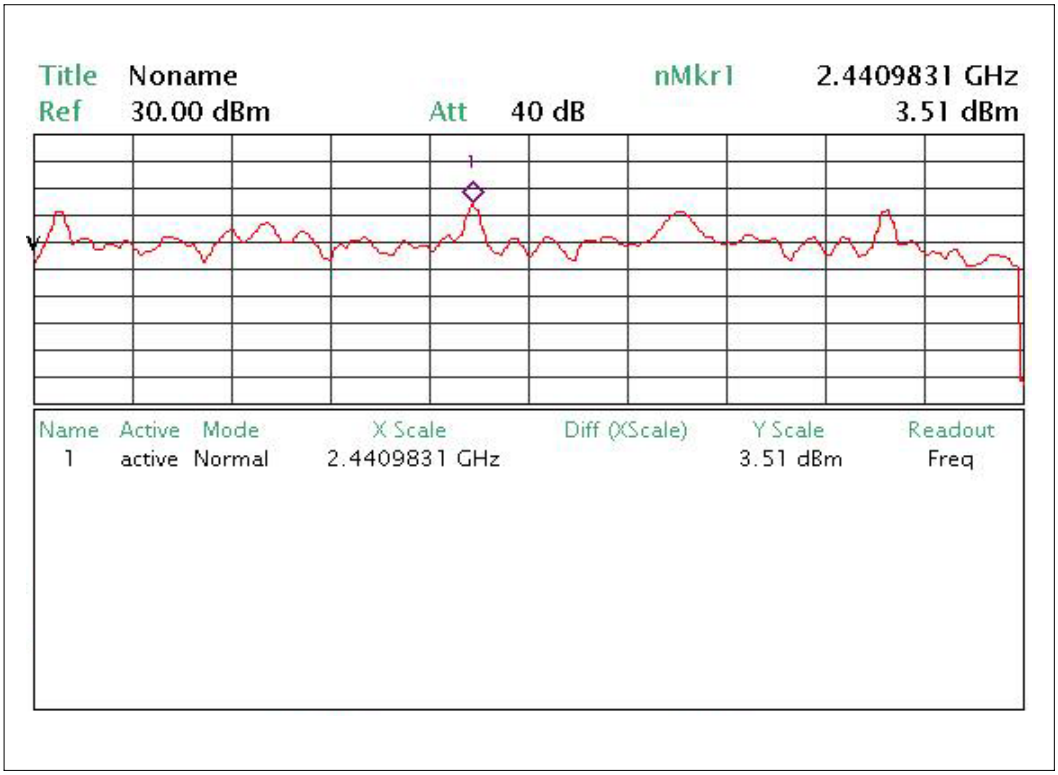
Modulation	Frequency (MHz)	Reading Power (dBm)	Limit (dBm)	Verdict
GFSK	2405.6	4.16	8	Pass
	2441	3.51	8	Pass
	2477.6	2.34	8	Pass

Figure 3. Plot of the Power Spectral Density

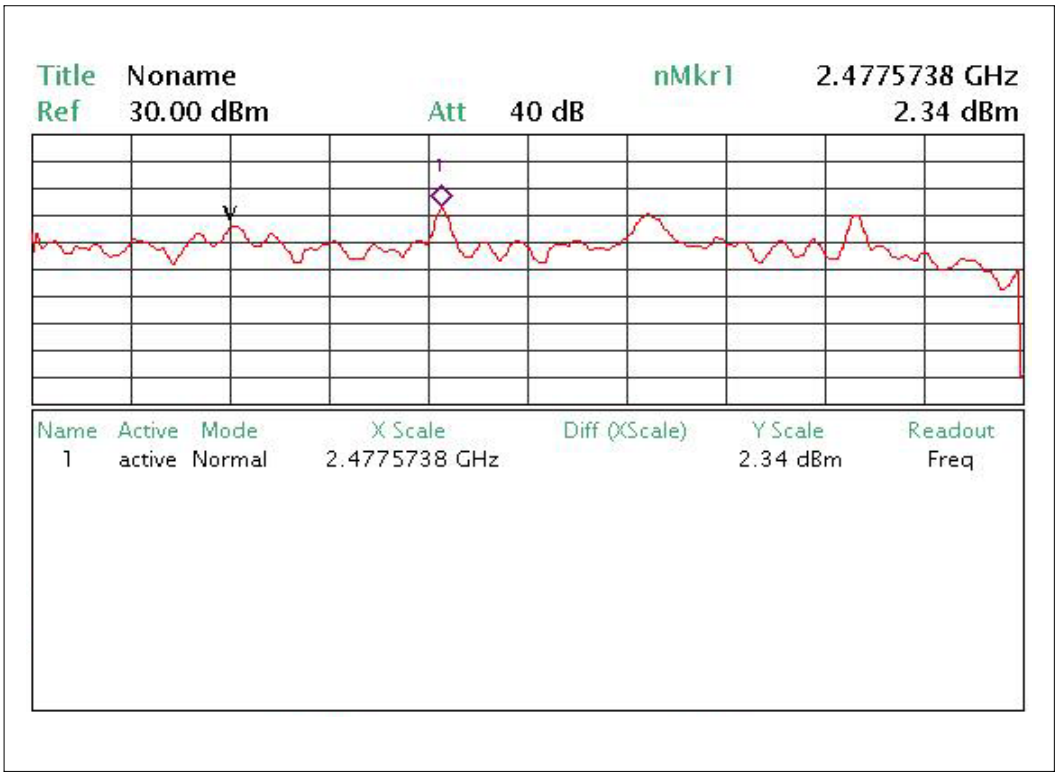
Lowest Channel (2405.6 MHz)



Middle Channel (2441 MHz)



Highest Channel (2477.6 MHz)



5.5 CARRIER FREQUENCY SEPARATION

5.5.1 Regulation

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

According to §RSS-210, A8.1(b), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

5.5.2 Test Condition

- Set RBW of Spectrum analyzer to 10 kHz, Span=3MHz, Sweep=auto
- Frequency hopping system shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

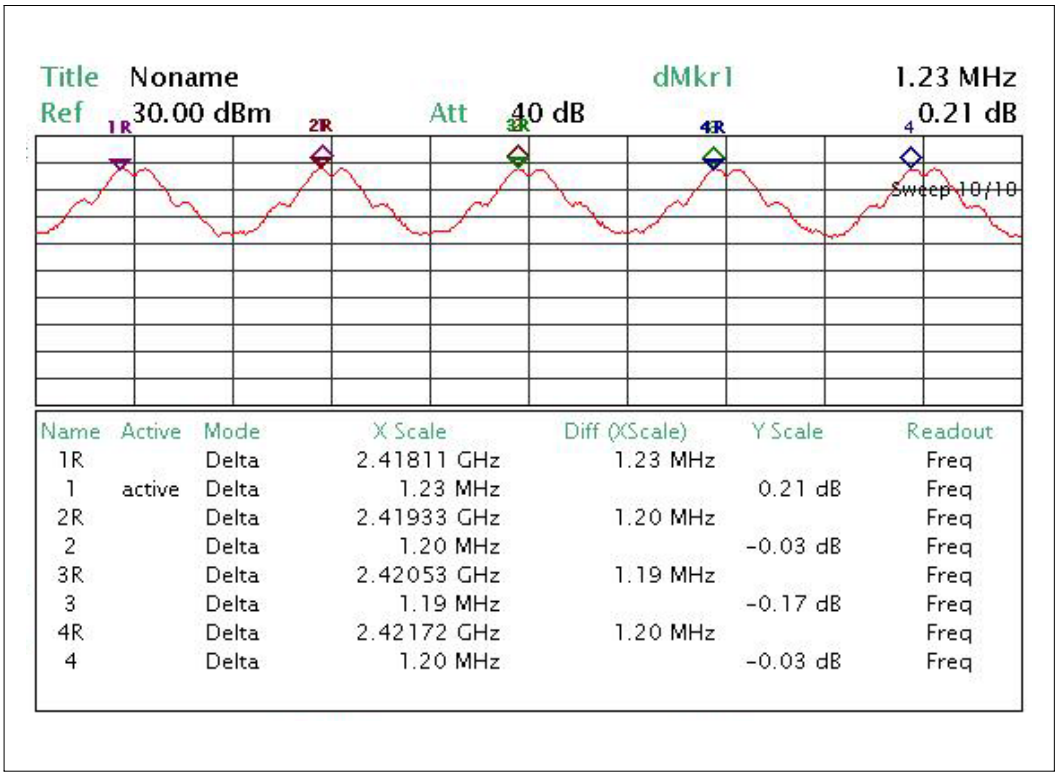
5.5.3 Test result : PASS

Table 4 : Measured values of the Carrier Frequency Separation

Modulation	Channel separation (MHz)	20 dB bandwidth (kHz)	Limit (frequency separation)	Verdict
GFSK	1.19(Worst)	753(Worst)	≥ 25 kHz or 20 dB bandwidth, whichever is greater	Pass

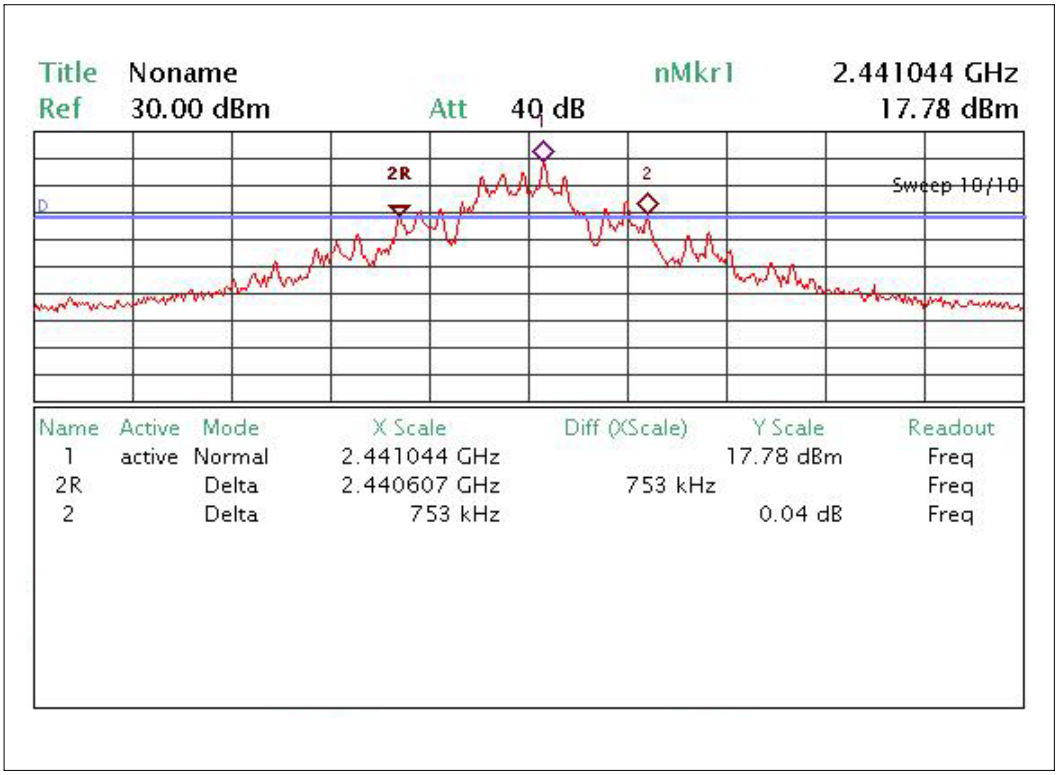
Figure 4. Plot of the Carrier Frequency Separation

Carrier Frequency Separation



Name	Active	Mode	X Scale	Diff (XScale)	Y Scale	Readout
1R		Delta	2.41811 GHz	1.23 MHz		Freq
1	active	Delta	1.23 MHz		0.21 dB	Freq
2R		Delta	2.41933 GHz	1.20 MHz		Freq
2		Delta	1.20 MHz		-0.03 dB	Freq
3R		Delta	2.42053 GHz	1.19 MHz		Freq
3		Delta	1.19 MHz		-0.17 dB	Freq
4R		Delta	2.42172 GHz	1.20 MHz		Freq
4		Delta	1.20 MHz		-0.03 dB	Freq

20dB Bandwidth



Name	Active	Mode	X Scale	Diff (XScale)	Y Scale	Readout
1	active	Normal	2.441044 GHz		17.78 dBm	Freq
2R		Delta	2.440607 GHz	753 kHz		Freq
2		Delta	753 kHz		0.04 dB	Freq

5.6. NUMBER OF HOPPING CHANNELS

5.6.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

According to §RSS-210, A8.1(d), Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

5.6.2 Test Condition

- Set RBW of Spectrum analyzer to 100 kHz
- Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

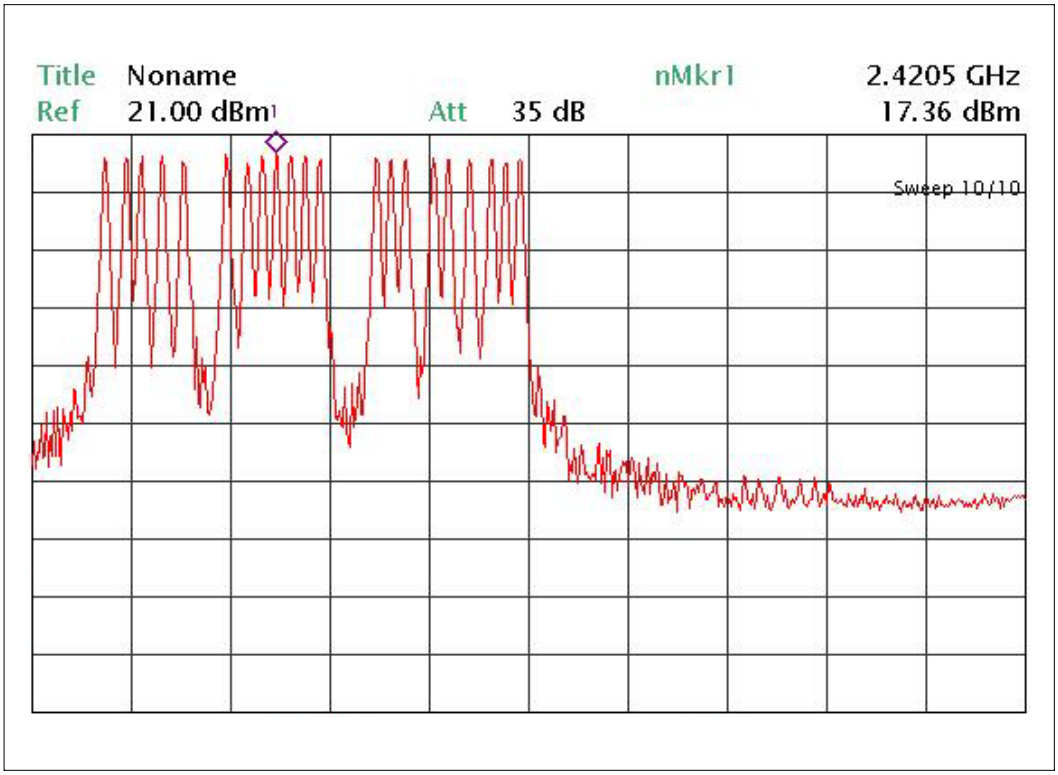
5.6.3 Test result : PASS

Table 5 : Measured values of the Number of Hopping Channels

Modulation	Operating frequency (MHz)	Result (channel)	Limit (channel)	Verdict
GFSK	2405.6 ~ 2477.6MHz	21	>15	Pass

Figure 5. Plot of the Number of Hopping Channels

2405.6 ~ 2477.6MHz



5.7 TIME OF OCCUPANCY (DWELL TIME)

5.7.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

According to §RSS-210, A8.1(d), Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

5.7.2 Test Condition

- Set RBW of Spectrum analyzer to 3 MHz, sweep time is 4.0 ms
- Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.7.3 Test result : PASS

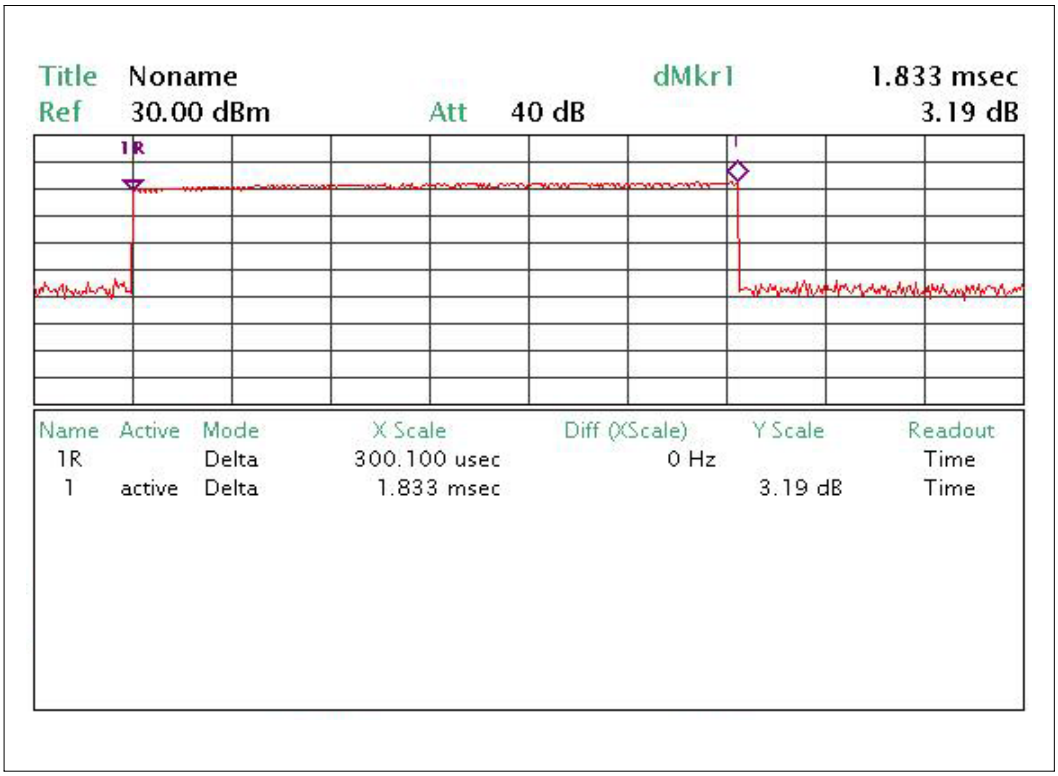
Table 6 : Measured values of the Dwell Time

Modulation	Operating frequency (MHz)	Reading (ms)	hop rate (hops/s)	Number of hopping Channels	Period Time	Dwell time (ms)	Limits (ms)	Verdict
GFSK	2405.6 MHz	1.833	0.047	21	8.4	34.46	≤ 400	Pass
	2441 MHz	1.833	0.047	21	8.4	34.46	≤ 400	Pass
	2477.6 MHz	1.833	0.047	21	8.4	34.46	≤ 400	Pass

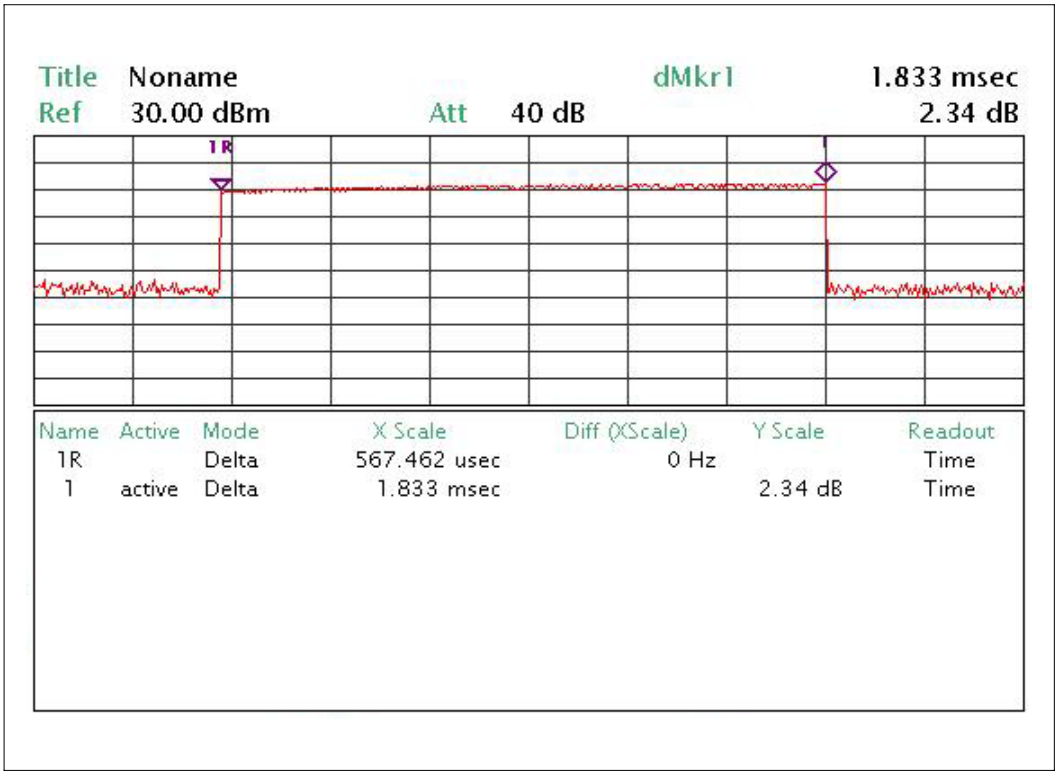
Remark: Dwell time = Reading × (Hopping rate / Number of channels) × Period Time
Period Time = 0.4[seconds / channel] × 21[Hopping Channel]

Figure 6. Plot of the Carrier Dwell Time

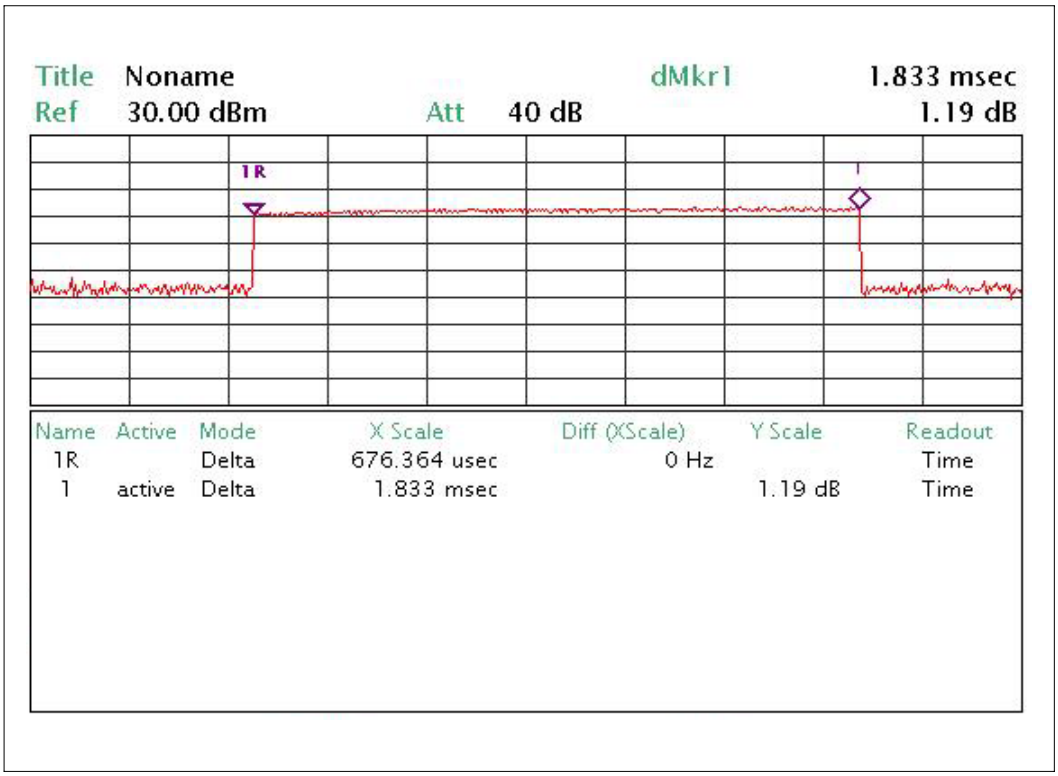
Lowest Channel (2405.6 MHz)



Middle Channel (2441 MHz)



Highest Channel (2477.6 MHz)



5.8 SPURIOUS EMISSIONS, BAND EDGE, AND RESTRICTED BANDS

5.8.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §RSS-210, A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

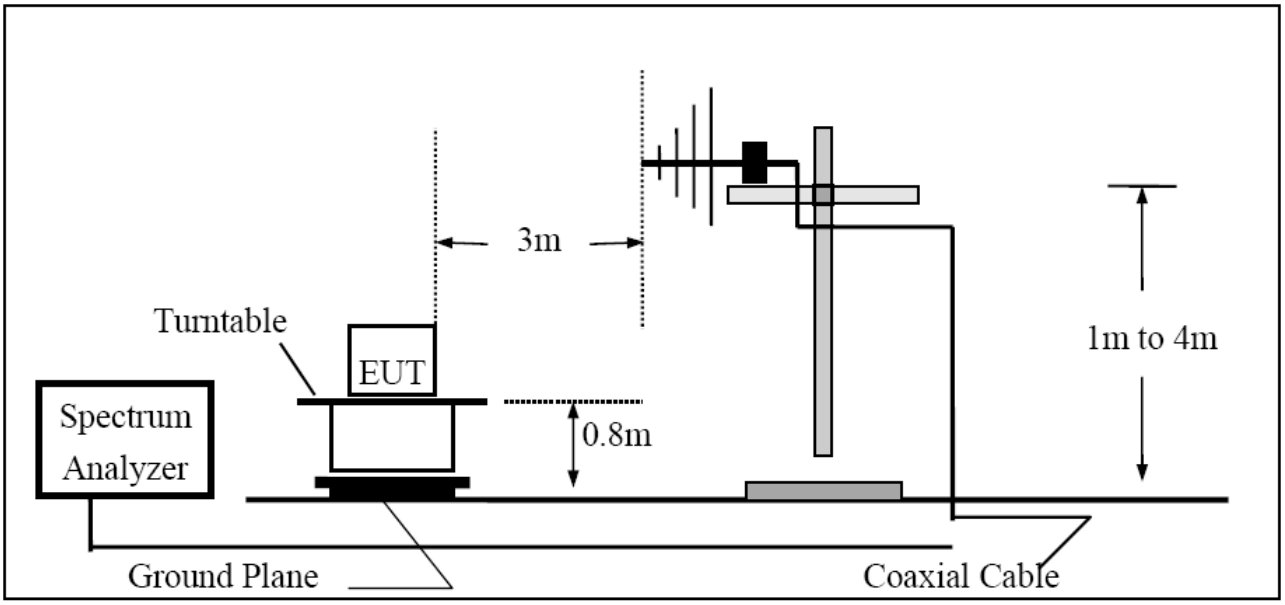
Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

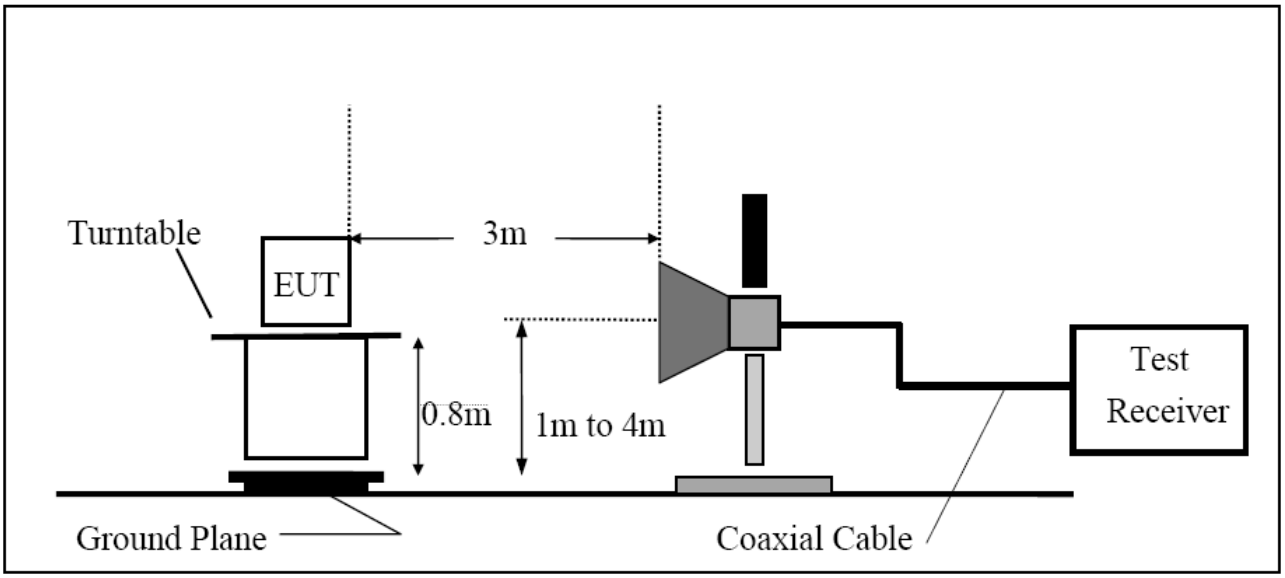
** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

5.8.2 Test Setup Layout

5.8.2.1 Radiated Emission Test Set-Up, Frequency Below 1000MHz



5.8.2.2 Radiated Emission Test Set-UP Frequency Over 1000MHz



5.8.3 Test Procedure

1) Band-edge Compliance of RF Conducted Emissions

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.

3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

5.8.4 Test Results: **PASS**

Band-edge compliance of RF conducted/radiated emissions was shown in the Figure 7 and Figure 8

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Spurious RF conducted emissions were shown in the Figure 9

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

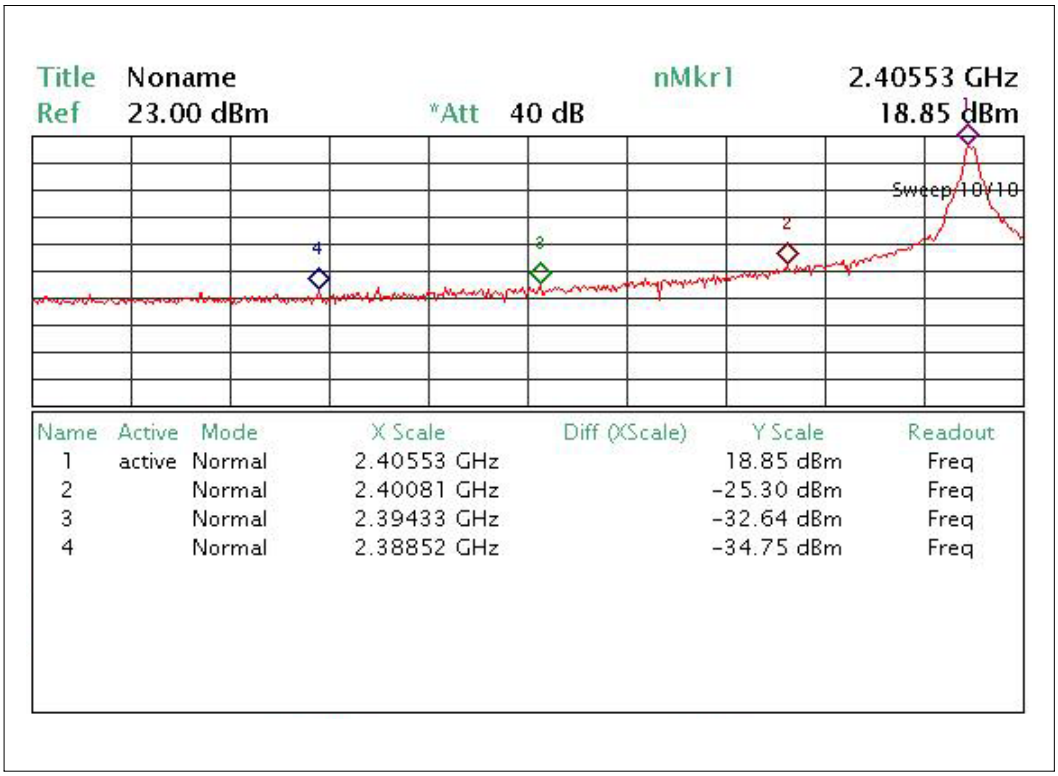
Table 7 : Measured values of the Field strength of spurious emission (Transmit mode)

Frequency (MHz)		Detect Mode	Polarization (V/H)	Turn Table (degree)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Average/Peak/Quasi-peak data, emissions below 30 MHz										
		No Spurious Radiated Emissions Found								
Quasi-peak data, emissions below 1000 MHz										
2405.6MHz	553.6	QP	V	45	12.56	23.16	-	35.72	46.02	10.3
	601.8	QP	V	157	8.59	24.39	-	32.98	46.02	13.04
2441MHz	472.9	QP	V	61	6.21	22.72	-	29.93	46.02	16.09
	534.3	QP	V	152	7.36	23.62	-	30.98	46.02	15.04
2477.6MHz	568.5	QP	V	59	8.73	23.56	-	32.29	46.02	13.73
	599.1	QP	V	231	8.06	23.85	-	31.91	46.02	14.11
Peak/Average data, emissions above 1000 MHz										
2405.6MHz	7148.7	Peak	V	195	35.67	50.34	-23.85	62.16	74	11.84
	7148.7	Average	V	195	14.61	50.34	-23.85	41.10	54	12.9
	10075.9	Peak	H	82	25.63	59.13	-19.56	65.20	74	8.8
	10075.9	Average	H	82	8.73	59.13	-19.56	48.30	54	5.7
2441MHz	7227.5	Peak	V	215	34.68	51.66	-23.85	62.49	74	11.51
	7227.5	Average	V	215	18.72	51.66	-23.85	46.53	54	7.47
	10572.3	Peak	H	65	26.52	59.48	-19.56	66.44	74	7.56
	10572.3	Average	H	65	8.79	59.48	-19.56	48.71	54	5.29
2477.6MHz	7316.7	Peak	V	275	38.16	51.47	-23.85	65.78	74	8.22
	7316.7	Average	V	275	19.28	51.47	-23.85	46.90	54	7.1
	12025.6	Peak	H	184	29.31	59.57	-19.56	69.32	74	4.68
	12025.6	Average	H	184	8.71	59.57	-19.56	48.72	54	5.28

1. Margin (dB) = Limit − Emission Level
2. H = Horizontal, V = Vertical Polarization

Figure 7. Plot of the Band Edge (Conducted)

Lowest Channel (2405.6 MHz)



High Channel (2477.6 MHz)

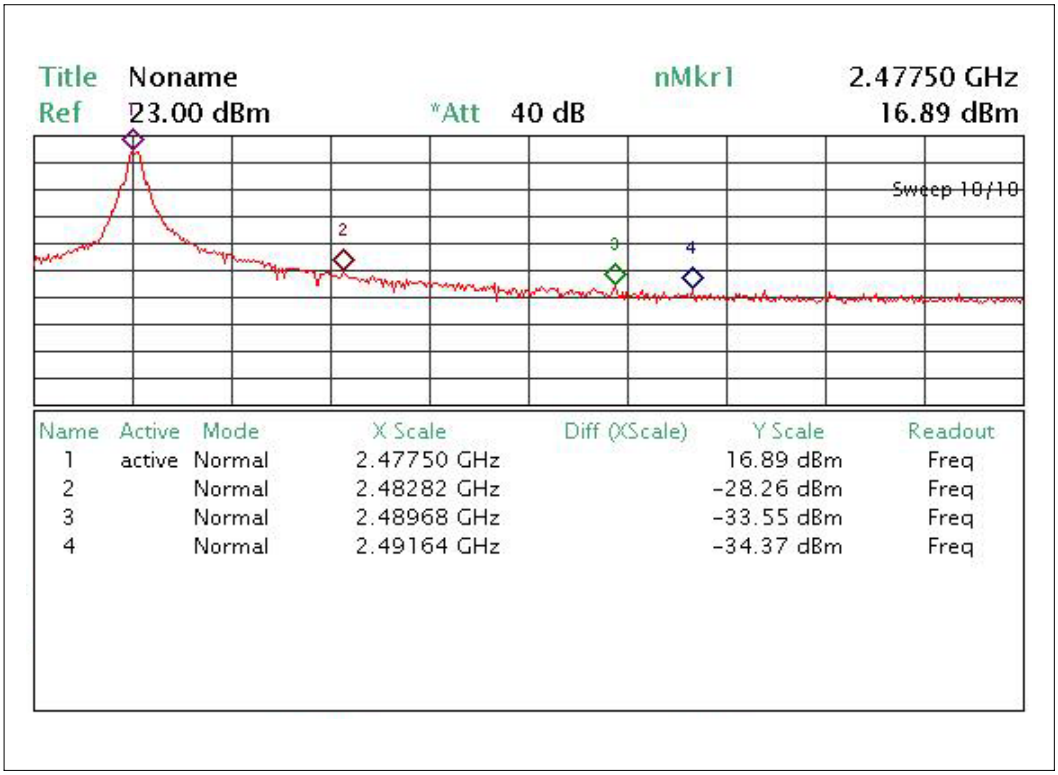
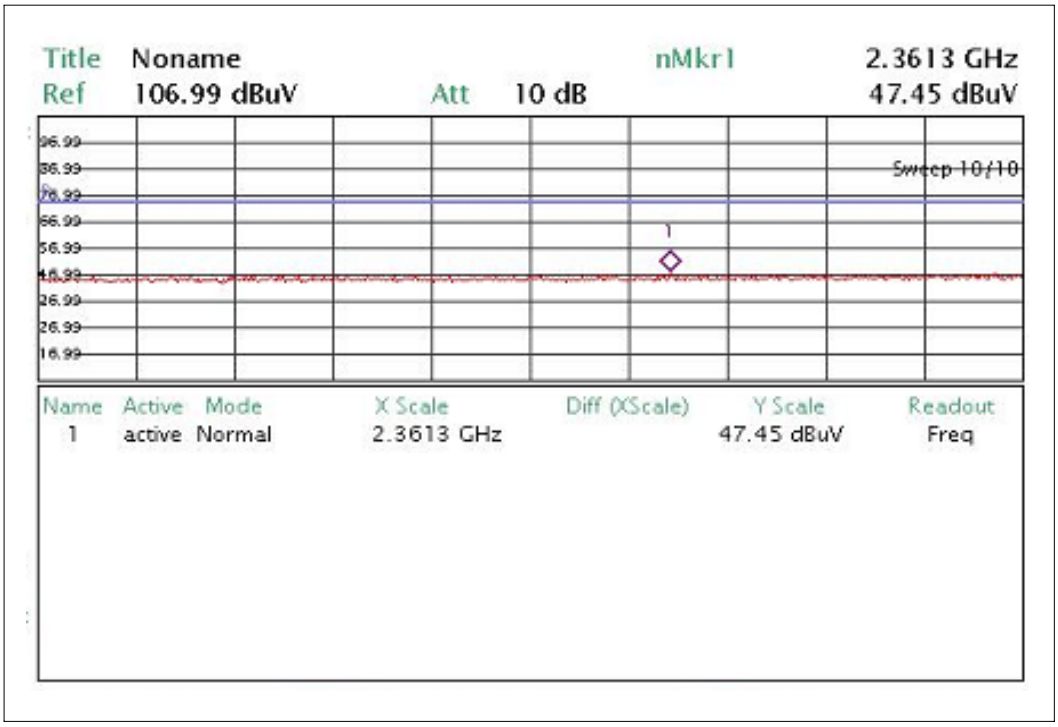
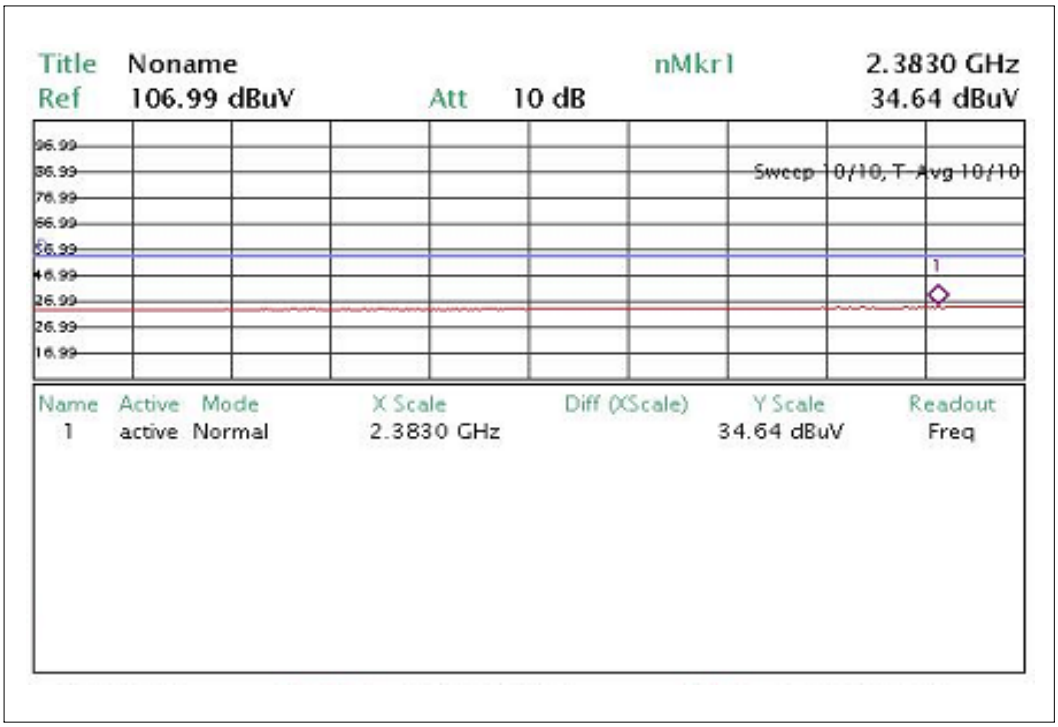


Figure 8. Plot of the Band Edge (Radiated)

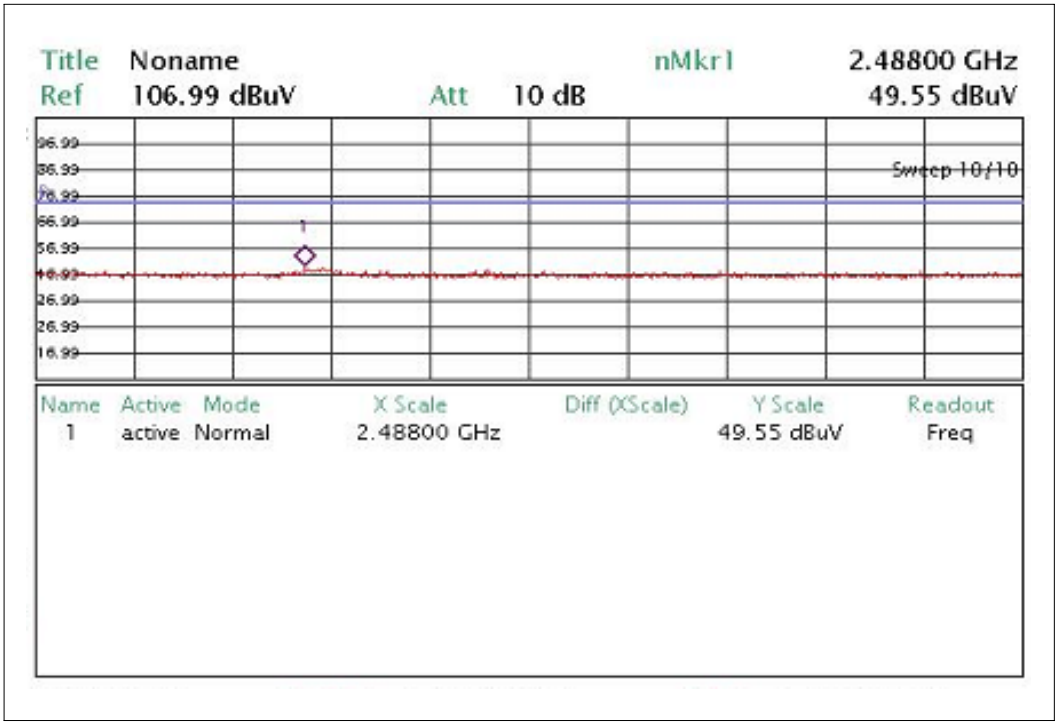
Lowest Channel (2405.6 MHz) - Peak



Lowest Channel (2405.6 MHz) - Average



High Channel (2477.6 MHz) - Peak



High Channel (2477.6 MHz) - Average

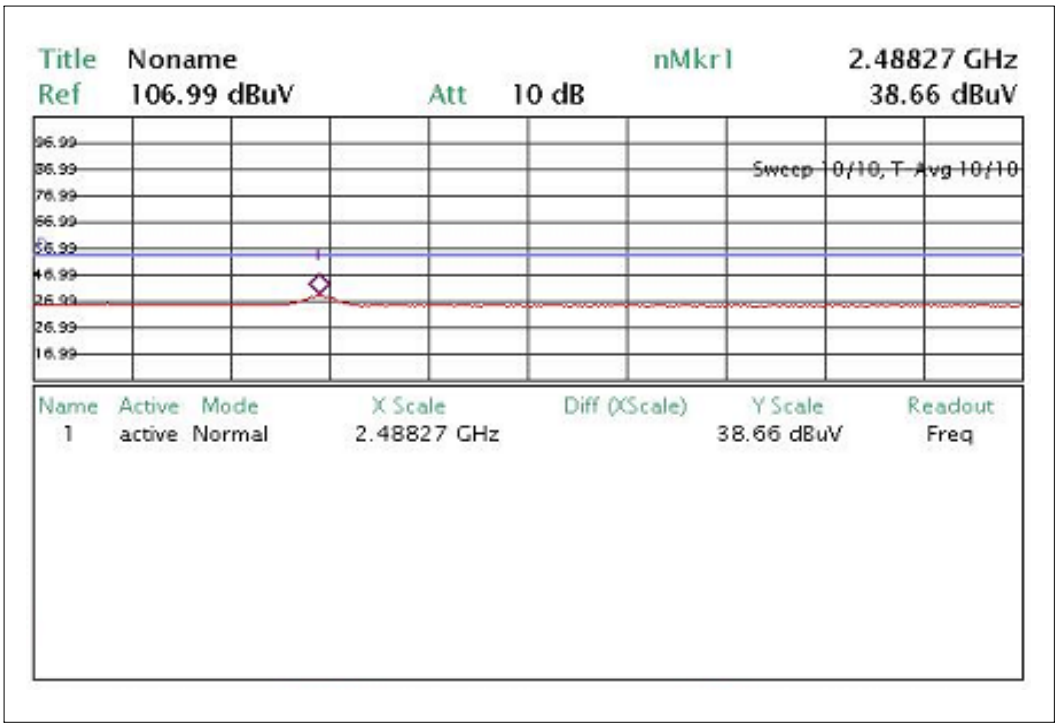
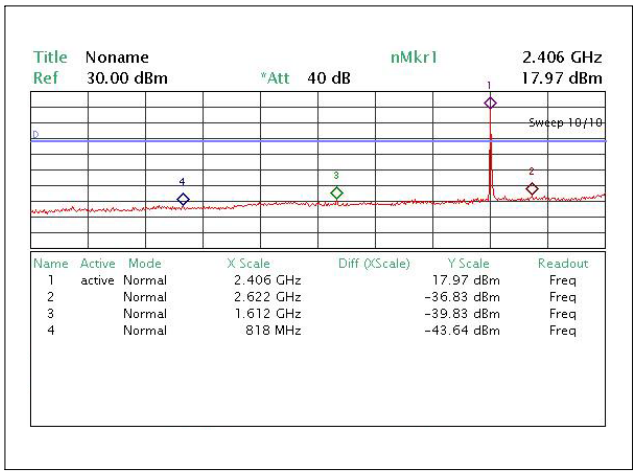
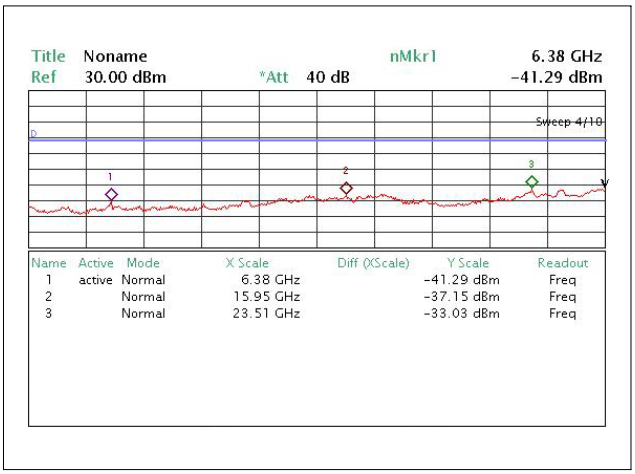


Figure 9. Plot of the Spurious RF conducted emissions

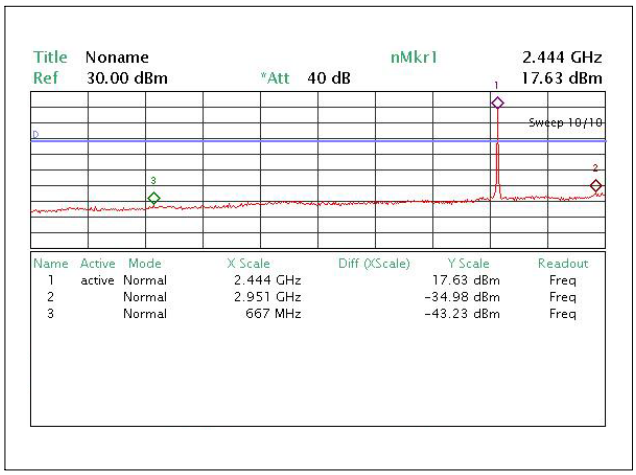
Lowest Channel (2405.6 MHz) : 30MHz ~ 3GHz



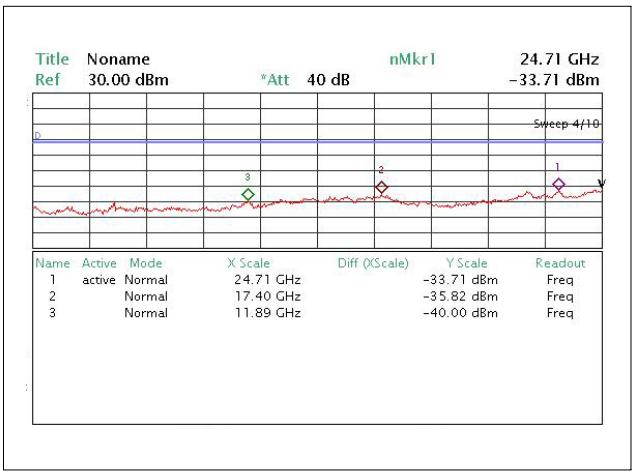
Lowest Channel (2405.6 MHz) : 3GHz ~ 26.5GHz



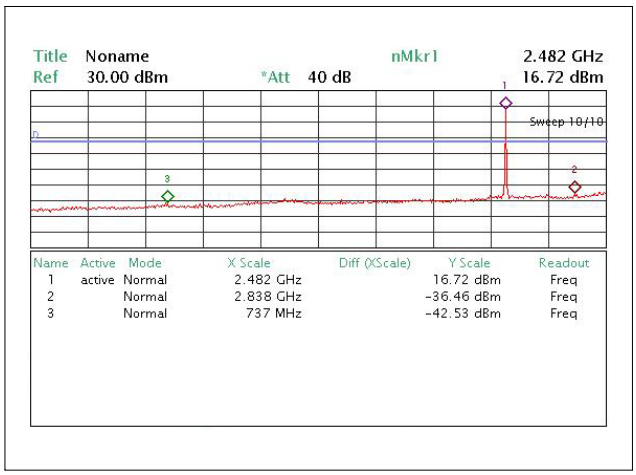
Middle Channel (2441 MHz) : 30MHz ~ 3GHz



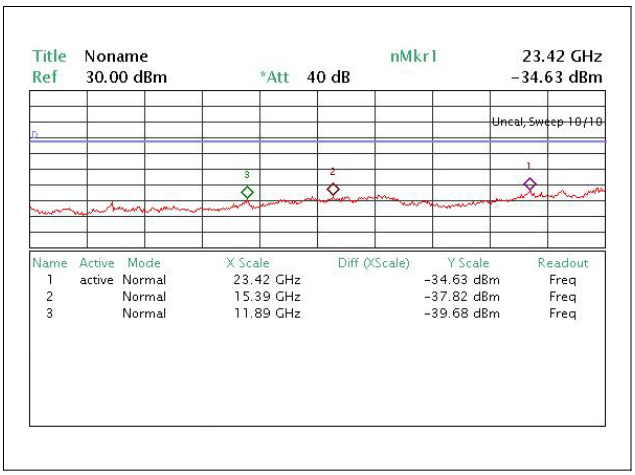
Middle Channel (2441 MHz) : 3GHz ~ 26.5GHz



Highest Channel (2477.6 MHz) : 30MHz ~ 3GHz



Highest Channel (2477.6 MHz) : 3GHz ~ 26.5GHz



5.9 RECEIVER SPURIOUS EMISSIONS

5.9.1 Regulation

According to RSS-Gen 7.2.3, the following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1. The resolution bandwidth of the spectrum analyzer shall be 100 kHz for spurious emission measurements below 1.0 GHz, and 1.0 MHz for measurements above 1.0 GHz.

Spurious Emission Limit for Receivers

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

* Use quasi-peak below 1000 MHz and averaging meter above 1000 MHz.

5.9.2 Test Results: **PASS**

Table 8 : Measured values of the Receiver Spurious Emissions

Frequency (MHz)		Detect Mode	Polarization (V/H)	Turn Table (degree)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Quasi-peak data, emissions below 1000 MHz										
2405.6MHz	473.5	QP	V	48	10.18	23.42	-	33.60	46.02	12.42
	728.8	QP	V	154	8.06	24.37	-	32.43	46.02	13.59
2441MHz	419.4	QP	V	37	7.72	22.19	-	29.91	46.02	16.11
	492.2	QP	V	142	7.08	23.76	-	30.84	46.02	15.18
2477.6MHz	481.7	QP	V	66	8.91	24.54	-	33.45	46.02	12.57
	524.6	QP	V	212	8.37	24.86	-	33.23	46.02	12.79
Peak/Average data, emissions above 1000 MHz										
2405.6MHz	7145.5	Peak	V	187	38.37	51.65	-23.2	66.82	74	7.18
	7145.5	Average	V	187	16.48	51.65	-23.2	44.93	54	9.07
	1003.7	Peak	H	95	26.27	59.32	-23.2	62.39	74	11.61
	1003.7	Average	H	95	8.73	59.32	-23.2	44.85	54	9.15
2441MHz	7278.2	Peak	V	273	37.82	51.49	-23.2	66.11	74	7.89
	7278.2	Average	V	273	12.93	51.49	-23.2	41.22	54	12.78
	10670.1	Peak	H	62	22.71	60.88	-23.2	60.39	74	13.61
	10670.1	Average	H	62	8.49	60.88	-23.2	46.17	54	7.83
2477.6MHz	7384.3	Peak	V	241	33.29	53.46	-23.2	63.55	74	10.45
	7384.3	Average	V	241	12.26	53.46	-23.2	42.52	54	11.48
	11371.8	Peak	H	189	21.93	59.36	-23.2	58.09	74	15.91
	11371.8	Average	H	189	9.75	59.36	-23.2	45.91	54	8.09

1. Margin (dB) = Limit − Emission Level
2. H = Horizontal, V = Vertical Polarization

5.10 RF EXPOSURE

According to §KDB 447 498 D01 V04 4(c)(iii), (1) Hand SAR is required for hand-held and hand-operated devices with output power > 1000[f(GHz)]-0.5 mW that are designed with the hand operating closer than 5 cm from the antenna during normal use. (2) Extremity SAR is required for wrist, feet or ankle worn devices. (3) Body SAR is required for hand-held and hand-operated or wrist, feet and ankle worn devices that operate closer than 5 cm to the body and the output power is > 300[f(GHz)]-0.5 mW.

Technical Information:

Antenna Type: 1/2 Wave Dipole antenna
Antenna Gain: 0.71dBi
Maximum Transmitter Conducted Power: 18.60dBm, 72.44mW
Maximum System EIRP: 19.34dBm, 86.49mW

RF Exposure Compliance Justification:

1) Hand SAR

Model ECL7PRO24G is exempt from SAR based on the output power (higher of conducted or EIRP) being < 1000*[f(GHz)]^(-0.5)mW. SAR threshold and maximum equipment EIRP calculations are provided below.
MPE calculations are also provided for satisfying mobile RF exposure conditions.

SAR Threshold = 1000*[2.4056]^(-0.5)mW = 644.75mW
Maximum Equipment EIRP = 86.49mW

2) Body SAR

Model ECL7PRO24G is exempt from SAR based on the output power (higher of conducted or EIRP) being < 300*[f(GHz)]^(-0.5)mW. SAR threshold and maximum equipment EIRP calculations are provided below.
MPE calculations are also provided for satisfying mobile RF exposure conditions.

SAR Threshold = 300*[2.4056]^(-0.5)mW = 193.42mW
Maximum Equipment EIRP = 86.49mW

MPE Calculation

The Power Density (mW/cm2) is calculated as follows:

$S = PG/4\pi R^2$

$(\Rightarrow R = \sqrt{PG/4\pi S})$

S = power density [mW/cm^2]
P = power input to antenna [mW]
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna [cm]

MPE Calculator for Mobile Equipment Limits for General Population/Uncontrolled Exposure							
Transmit Frequency (MHz)	Radio Power (dBm)	Radio Power (mW)	Antenna Gain (dBi)	Antenna Gain (mW eq.)	Distance (cm)	Power Density (mW/cm^2)	Power Density Limit (mW/Cm^2)
2405.6	18.60	72.44	0.71	1.17	20	0.0169	1.0

Installation Guidelines

The installation manual should contain text similar to the following advising how to install the equipment to maintain compliance with the FCC RF exposure requirements:

RF Exposure

In accordance with FCC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20 centimeters will be maintained.

Conclusion

This device complies with the MPE requirements by providing adequate separation between the device, any radiating structure and the general population.

APPENDIX

TEST EQUIPMENT USED FOR TESTS

No.	Description	Manufacturer	Model No.	Specifications	Next Cal. Data	Used equipment
1	EMI Test Receiver	LIG Nex1	LSA-265	3Hz~26.5GHz	11.12.18	■
2	Dipole ANT	ElectroMetrics	TDA-30/1-4	30~1GHz	12.03.23	□
3	Biconical ANT	ElectroMetrics	BIA-30S	30~300MHz	12.03.23	■
4	Log periodic ANT	ElectroMetrics	LPA-30	0.2~1GHz	12.03.23	■
5	Bilog Antenna	Schaffner-Chase EMC Ltd.	CBL6140A	50V, 5A	12.05.07	■
6	Turn Table	KEI	KEI-TURN	1500×1000×800	N/A	□
7	Turn Table	KEI	KEI-TURN	1500×1000×800	N/A	■
8	Loop ANT.	Com-Power	AL-130	9kHz~30MHz	13.04.21	□
9	Spectrum Analyzer	LIG Nex1	ISA-265	1kHz~26.5GHz	12.05.24	■
10	Function Generator	Agilent	33120A	15MHz sine&square	12.06.08	□
11	Frequency Counter	HP	5350B	10Hz~20GHz	12.06.08	□
12	Modulation Analyzer	Agilent	8901B	10MHz~1.3GHz	12.06.08	□
13	Audio Analyaer	Agilent	8903B	20Hz~100kHz	12.06.08	□
14	Attenuator	Agilent	8494B	0~11dB, 18GHz	12.06.08	□
15	Attenuator	Agilent	8496B	0~110dB, 18GHz	12.06.08	□
16	Attenuator	Agilent	8495B	0~70dB, 18GHz	12.06.08	□
17	Attenuator	TAE SUNG	SMA-1	6dB	11.09.02	□
18	Attenuator	TAE SUNG	SMA-2	6dB	11.09.02	□
19	Power Meter	Agilent	E4418B	100kHz~110GHz, 0.0001uW~25100mW	12.06.08	■
20	Power Sensor	HP	8485A	50MHz~26.5GHz	12.06.08	■
21	Vibration Tester	Gana	GNV-400	10~60Hz, 0~4mm	12.06.08	□
22	RF Cable	Gigalane	SMS-LL280-SMS -1.5M	1.5m	N/A	■
23	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	-40~150℃, 30~98%	12.06.08	■
24	Signal Generator	Leader Electronics	3220	100kHz~1.3GHz	12.06.08	■
25	Oscilloscope	Tektronix	TDS-350	200MHz	11.09.02	□
26	Drop Tester	Self-made	KSQ-01	150cm	N/A	□
27	Pre Amplifier	GTC	GA-1825A	0.1~18GHz	12.06.08	■
28	Continuous operation tester	GTC	CT-100	Local Control	N/A	□
29	CW Generator	HP	83711B	1~20GHz	12.06.08	■
30	POWER DIVIDER	Agilent	11636B	26.5GHz	12.06.08	□
31	Power Sensor	Agilent	8482B	100kHz ~ 4.2GHz	12.06.08	□
32	Attenuator	Winswell	53-30-33	dc-2.5GHz, 500W	12.06.08	□
33	DC Power Supply	Hanil	HPS-505A	50V, 5A	11.09.02	□
34	Slidacs	Hanchang	5KV	5kW, 300V	11.09.02	□
35	Termination	Kwang Yeok	KYTE-NJ-150W	150W	11.09.02	□
36	Band-limited filter	MITECH	KSQ-02	600Ω	11.09.02	□
37	Signal Generator	WILTRON	6759B	10MHz ~ 26.5GHz	11.09.02	□
38	Digital Multimeter	DONG HWA	DM-300A	AC/DC 500V Max,320mA Max	11.09.02	■
39	Horn ANT.	SCHWARZBECK	BBHA 9120D	700MHz ~ 18GHz	11.09.23	■
40	DC Power Supply	ALINCO	DM-340MW	15V, 30A	11.09.02	■

APPENDIX

1. EUT photo